DOCUMENT RESUME

ED 194 367 SE 033 242

AUTHOR Richardson, W. D.; Johnson, Linda
TITLE Measuring Teachers' Attitudes About Energy and Related Subjects.
PUB DATE 13 Apr 80
NOTE 20p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (53rd, Boston, MA, April 11-13, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Attitude Change; Attitude Measures; *Energy; Graduate Students; Higher Education; Social Problems; *Teacher Attitudes; Teacher Characteristics; *Teacher Workshops; Technology

ABSTRACT

A pretest-posttest control group study revealed changes in teachers' attitudes regarding energy subsequent to their participation in energy workshops. Five experimental groups representing a total of 91 teachers who were enrolled in graduate programs took part in energy workshops conducted at various Texas universities. The control group of 19 students participated in a teacher education course with no emphasis on energy. To measure attitudes concerning energy and related areas, the researchers developed a Likert-type scale which they refined through factor analysis and submission to a panel of five experts in the energy field. Comparison of pretest and posttest measures showed significantly higher "pro-energy" attitudes for four treatment groups following the workshops. No significant differences were found for the control group or for the remaining treatment group. Analysis of covariance revealed no significant differences among posttest means based on participants' subject area, grade level assignment, or sex. (WB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED194367

MEASURING TEACHERS' ATTITUDES ABOUT ENERGY AND RELATED SUBJECTS

A Research Paper Presented to the
National Association for Research in Science Teaching

Boston, Massachusetts

April 13, 1980

W. D. Richardson and Linda Johnson

East Texas State University

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

W. D. Richardson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE 033 242

MEASURING TEACHERS' ATTITUDES
ABOUT ENERGY AND RELATED SUBJECTS

RATIONALE AND PURPOSE

Americans continue to search for a villain to blame for the inconvenience, shortage, and higher prices caused by a lack of available energy at an economical price. Few Americans have a good understanding of the total energy situation and the efforts of the government in trying to provide an informed populace. Teachers in particular have a responsibility to be informed on current conditions in all segments of our society. Because of this need, the government (DOE) and various energy producers are providing financial support to colleges and universities for the purpose of conducting energy education workshops for teachers. A survey of available print media indicates that little or no research is being done to investigate the effectiveness of these programs, and apparently none is being done to determine attitudinal change taking place among the participants of such workshops. Because of this absence of evaluation effort, there is an identified need to investigate the effectiveness and value of these programs and to report the findings. In response to this need, this study was initiated to measure attitudinal change of participants during the various workshops being conducted on four different university campuses in Texas.

The objectives of the study were:

(1) to design a Likert-type scale for measuring attitudes of participants in energy workshops concerning energy and related subjects;

(2) to pretest and posttest participants in five different programs conducted on four university campuses;

(3) to apply statistical procedures in determining significant changes in attitudes about energy and related matters as a result of participation in energy education workshops.

INSTRUMENT DESIGN

Initially, an item pool of eighty-six Likert type statements was constructed with a five point strongly agree to strongly disagree response continuum. The original instrument was administered to 205 individuals enrolled in graduate teacher education courses. Coefficients of correlation were computed on each pair of variables which resulted in an 86 x 86 intercorrelation matrix. This matrix provided the basic structure necessary for factor analysis of the data. Factors were extracted based on eigenvalues equal to or greater than one which resulted in 29 factors being identified. These factors accounted for 78.2 percent of the total variance. The unrotated factor matrix was then rotated using an orthogonal method and sorted by rearranging the extracted factors so that columns appeared in decreasing order of variance. Nineteen factors loaded singly, four factors had double loadings, three with triple loadings, and three factors had multiple loadings of five or six.

All factors and corresponding statements were transferred to 5 x 8 index cards with the following information identified: (1) factor loadings on each item, (2) group mean scores on each statement, and (3) the total number of respondents on each numerical value on each statement. This information is presented using an example of factor #1 in Appendix I.

Each factor was then evaluated by the two researchers and by three individuals working in the energy producting field. Each rater was asked to identify the statement(s) that should be included where multiple loadings were present. Relevance to overall attitude domain, discriminability, length of item, clarity of statements and factor loadings were employed by each rater in arriving at the items he/she thought should be included in the final instrument. No item was included with a factor loading less than .5000, while most factors were represented by a statement with a loading in the .7000 to .8000 range each.

Each rater was then asked to read each statement to see if it was stated in a pro or anti-energy position.

DISCRIPTION OF INSTRUMENT

Twenty statements were included in the instrument administered to the workshop participants. This instrument provided a scaling procedure commonly associated with measuring attitudes. A five point scale in which the interval between each point was assumed to be equal was created. The instrument was designed to register the extent of agreement or disagreement with a particular statement. Eleven statements were stated in a positive direction and scored as follows: Strongly agree - 5, Agree - 4, Undecided - 3, Disagree - 2, and Strongly disagree - 1. The scoring for statements written in a negative manner were reversed in order to provide a total score that reflects positiveness toward the item in question. In this way a person favoring some energy related matter will agree with positive items and disagree with negative ones while the opposite would be true for someone opposing a particular view. Example of the instrument is presented in Appendix C.

DESCRIPTION OF GROUPS

All groups were comprised of graduate students who occupied teaching positions at some level of education. Each group was comprised of both males and females with different academic preparations and different grade level responsibilities.

ETSU-E was comprised of 18 participants in a program conducted in the department of education at East Texas State University. This group met for twelve seven-hour days and had many of the same presentors as groups 2, 3, and 4.

NTSU-E was comprised of 18 participants in a program conducted in the department of education at North Texas State University. This group met for the same amount of time as did Group 1. Many of the same presentors were utilized.

BU-B was comprised of 17 participants in a program conducted in the department of business at Baylor University. This group met for eight seven-hour days and had many of the same presentors as Groups 1, 2, and 4.

SFA-G was comprised of 18 participants in a program conducted in the department of geography at Stephen F. Austin State University. This group met for twelve seven-hour days and had many of the same presentors as the other three groups mentioned earlier.

ETSU-C was comprised of 20 participants in an energy program conducted in the department of chemistry at East Texas State University. This group met for twenty-four four-hour days and had some of the same presentors as did groups 1, 2, 3, and 4.

CONTROL was a group comprised of 19 students enrolled for a summer course in teacher educacion with no emphasis on energy or related matters. This group met for twenty-four days for one

period.

PROCEDURES AND DATA

Each of the six groups was given a pretest at the first class meeting and a posttest at the last class meeting. A t-test of related means was employed to determine statistically significant differences in group attitudes as a result of participation in energy education workshops. A t-test was also utilized to measure change on individual items that comprised the total instrument.

Significant group changes were anticipated. The groups that changed significantly were combined to make a composite group. A simple analysis of covariance was employed to provide experimental control by statistically equating the initial individual differences of the subjects and the pretest was selected as the covariate. The composite group was studied according to subject areas taught, grade levels taught, and to sex of participants.

CONCLUSIONS AND DISCUSSION

The instrument designed to measure various constructs related to attitudes about energy and related matters seemed to be effective in identifying attitudinal change among energy education workshop participants as indicated by pretest and posttest scores. Four groups moved toward a definite and significant pro-energy position where attitudes were concerned. Table 1 shows total group performance and group performance on each variable that comprised the instrument.

(1) Significant differences were found between the pretest and posttest scores for four groups; ETSU-E, NTSU-E, BAYLOR-B, and SFASU-G. A significant t-score was obtained for all groups and each was significant at the .05 level and all in a positive direction.

Table 1

COMPOSITE t SCORES FOR ALL
ENERGY EDUCATION WORKSHOPS

Variable	ETSU-E	NTSU-E	BAYLOR-B	SFA-G	ETSU-C	CONTROL
1-N	-0.47	-1.84	0.20	1.87	-0.96	-0.15
2	0.55	1.46	0.38	.89	0.36	-0.25
3	-3.80	-0.62	-0.59	-0.19	-1.37	0.94
4	-0.70	0.44	0.24	-1.32	-0.20	1.68
5	-4.59	-5.77	-4.83	-6.71	-2.03	-1.88
6	5.11	1.64	6.06	2.85	2.70	-1.46
7-N	-2.56	-2.75	-1.23	-0.88	-0.49	-1.55
8-N	-8.09	-3.73	-4.24	-5.40	0.42	-0.70
9	-0.13	-1.84	2.06	-1.14	1.45	-1.84
10-N	-3.50	-0.68	-3.52	-0.53	-1.44	1.79
11-N	-6.06	-3.20	-3.12	-4.19	-2.26	-1.00
12-N	-1.23	-0.82	0.53	-1.84	0.72	-0.27
13	1.07	-0.57	2.40	-1.32	1.79	0.70
14	-1.00	-1.37	-2.07	-1.00	-1.71	0.62
15-N	-5.53	-1.07	-1.77	-2.65	-0.85	-0.55
16-N	0.19	0.0	-0.37	-2.40	0.52	0.32
17-N	4.93	-2.41	0.0	-2.92	0.82	-0.44
18	-1.00	-4.59	-2.34	-0.61	-2.57	-0.37
19	-4.12	-1.46	-1.32	-2.40	0.46	-0.44
20	0.0	-2.15	-0.77	-1.83	0.24	-1.65
TOTAL	-4.77	-5.66	-2.34	-6.21	-1.12	-1.74
egrees of Freedom	17	17	16	17	19	18
.05 Level	2.110	2.110	2.120	2.110	2.093	2.101

The program for each of these four groups was essentially the same with regards to organization, program participants and time alloted for workshop.

(2) No significant difference was found between the pretest and posttest scores for two groups; ETSU-C and the CONTROL group. The ETSU-C group was not organized in the same manner as the other groups and only a few of the same speakers appeared on the program. Time spent in class was approximately equal. The CONTROL group appears to have performed equally as well as the ETSU-C group and no energy education activities were part of the program.

The only identifiable difference in the programs was the reputation and quality of the speakers on the program. In those programs where significant changes in attitude were indicated, there were several speakers with national recognition in their respective fields and two of these had received international recognition.

(3) No significant differences were found among the posttest means of the composite group based on participants' subject area teaching assignment. Table II shows the obtained F and an indication that the subject area taught by participants did not unduly influence any change in attitudes as a result of participation in the workshop. However, mean gains were recorded for each group. (Appendix B)

(4) No significant differences were found among the posttest means of the composite group based on participants' grade level teaching assignment. Table III shows the obtained F and gives evidence that the grade level taught by participants did not unduly influence any change in attitudes as a result of participation in the workshop. However, mean gains were recorded in each case. (Appendix B)

Table II

ANALYSIS OF COVARIANCE* USING POSTTEST
MEANS BASED ON PARTICIPANTS SUBJECT AREA ASSIGNMENT**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Required F Ratio	Obtained F Ratio
Between	70.6086	2	35.3043	3.15	1.5041
Within	1619.5571	69	23.4718		

* Pretest scores used as covariate.

** Subject area assignment of participants:

Social Studies N = 10

Science N = 30

Other N = 33

Table III

ANALYSIS OF COVARIANCE* USING POSTTEST
MEANS BASED ON PARTICIPANTS GRADE LEVEL ASSIGNMENT**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Required F Ratio	Obtained F Ratio
Between	50.7246	2	25.3623	3.15	1.0674
Within	1639.4412	69	23.7600		

* Pretest scores used as covariate.

** Grade level assignments of participants:

High School	(9-12)	N = 29
Middle School	(6-8)	N = 26
Elementary School	(1-5)	N = 18

(5) No significant differences were found among the posttest means of the composite group based on participants sex. Table IV shows the obtained F and indicates that the sex of the participants did not unduly influence any change in attitudes as a result of participation in the workshop. However, mean gains were recorded for both males and females. (Appendix B)

There is evidence that item 6 on the instrument should be scaled differently with reverse numbering being in order. In all groups involved in energy education workshops the pretest score was higher than the posttest score which indicates that the groups attitudinal change was opposite of the prediction by all five instrument raters.

*This research was conducted with the assistance of a Faculty Research Grant from East Texas State University. All stastical work was completed in the university computer center and utilized the following programs from the University of California, Los Angeles, Health Sciences Computing Facility:

BMDP4M - Factor Analysis

BMDP1V - One-Way Analysis of Covariance

Table IV

ANALYSIS OF COVARIANCE* USING POSTTEST MEANS BASED ON PARTICIPANTS SEX**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Required F Ratio	Obtained F Ratio
Between	35.0044	1	35.0044	4.00	1.4804
Within	1655.1565	70	23.6451		

* Pretest scores used as covariate.

** Sex of participants:

Males N = 25

Females N = 48

APPENDIX A

FACTOR I
(Safety of Nuclear energy)

.803 67. Nuclear plants are not safe. (Mean 3.12) 7 - 34 - 39 - 27 - 4

.812 72. There is no known means of safety in handling high level nuclear waste. (Mean 2.98) 10 - 28 - 33 - 30 - 10

.779 77. I'm afraid of the development of the nuclear pellet produced energy because it resembles the atomic bomb. (Mean 3.26) 11 - 33 - 44 - 20 - 3

.719 78. I believe that nuclear energy is questionable since it is shrouded in uncertainties. (Mean 2.88) 7 - 26 - 33 - 37 - 8

.615 82. People should not be allowed to live near an operating nuclear plant. (Mean 2.97) 7 - 30 - 34 - 33 - 7

.535 85. The consequences of a nuclear accident will be catastrophic with heavy loss of life and multitudes of cancer cases. (Mean 2.83) 3 - 22 - 48 - 29 - 9

APPENDIX B

COMPOSITE GROUP MEAN GAIN BASED
ON SUBJECT AREA TEACHING ASSIGNMENT

Subject Taught	Number of Students	Means Pre & Post		Gain
Social Studies	10	Pre	67.5000	9.4000
		Post	76.9000	
Science	30	Pre	66.8665	6.8667
		Post	73.7332	
Other	33	Pre	66.1514	8.6364
		Post	74.7878	

COMPOSITE GROUP MEAN GAIN BASED ON
GRADE LEVEL ASSIGNMENT OF TEACHERS

Grade Level Taught	Number of Students	Means Pre & Post		Gain
Elementary 1-5	18	Pre	65.4444	9.4444
		Post	74.8888	
Middle School 6-8	26	Pre	66.8461	8.5384
		Post	75.3845	
High School 9-12	29	Pre	67.1723	7.4714
		Post	74.6437	

Cont. of Appendix B

COMPOSITE GROUP MEAN GAIN
BASED ON SEX OF PARTICIPANTS

Sex	Number of Students	Means Pre & Post		Gain
Male	25	Pre	67.2399	6.6800
		Post	73.9199	
Female	48	Pre	66.3123	8.7084
		Post	75.0207	

ENERGY ATTITUDE SCALE

1. Large and inefficient cars should not be taxed heavily.
2. America could solve its energy problems with a crash development program similar to NASA's Apollo moon project.
3. Energy-market imperfections could be virtually eliminated by allowing supply and demand to operate in a free market system.
4. Investments to increase energy production and conservation should be encouraged by adequate governmental incentives.
5. America should rely more heavily on nuclear energy in the future.
6. Since solar energy is free and plentiful, we should develop and implement it for immediate use.
7. Conservation of energy should solve our energy problems.
8. Nuclear plants are not safe.
9. The development of adequate alternative energy sources should be an immediate goal of the U.S.
10. The environmental problems associated with the use of fossil fuels can be easily and inexpensively managed.
11. I believe that the energy crisis presently existing is a hoax perpetrated by the energy-producing companies.
12. The government should not provide financial support for the development of unproven and costly alternative energy sources.
13. The U.S. must not be allowed to become more dependent on foreign energy sources.
14. Social unrest will develop without an adequate supply of energy.
15. Government should not deregulate energy production.
16. Americans should not accept the political risks involved in establishing a strong governmental energy policy that includes rigid enforcement.
17. Coal-produced energy should be seen as a costly threat to the environment.
18. In reality, all forms of energy use leave us with unwanted by-products.
19. The U.S. should remove the present laws that have made energy production a bureaucratic nightmare.
20. The development of adequate alternative energy sources for the U.S. is a long term goal.